reminding one of the "canals" of Schiaparelli. This special marking, which is not included in Mr. Green's map, may be identical with the network of dark narrow streaks figured in this region by Schiaparelli in his chart for January and February, 1882. It is also more or less definitely shown in some other drawings, notably on one by Schmidt, which forms No. 17 in Dr. Terby's Areography.

As to the Kaiser Sea, it appears very faint and narrow, if not really broken, in the region some 10° or 15° south of its north extremity. This peculiarity is well drawn in Herr Boeddicker's drawings of December 27, November 19, and December 26, 1881 (Nos. 11, 13, and 14) in the scientific *Transactions* of the Royal Dublin Society for December, 1882. Consulting other drawings I cannot find that this feature is sufficiently indicated. It is obvious, however, that it would only be well detected when placed near the apparent centre of the disk as during the recent opposition.

Mr. Knobel's drawings in 1873 (*Monthly Notices*, vol. xxxiii., facing p. 476) agree generally with mine far closer than those he has published in the *Memoirs*, vol. xlviii. part ii., 1884. I always see Knobel Sea on Green's chart separated on its south side from the fainter curving band running east, as in the sketches Nos. 6, 7, 8, and 9, 1873. This break is not depicted in the subsequent drawings of 1884, so that the appearance has either been subject to actual variation of aspect or the difference of inclination has originated the want of uniformity. Probably the latter is the real cause, for the inclination of Mars in April and May, 1873, was nearly identical with that of March and April, 1886, and it is for these periods the drawings are so nearly alike in their more conspicuous forms. I see the northern boundary of Knobel Sea distinctly separate from the dark longitudinal strip immediately contiguous to the north polar cap. The drawing No. 12, May 19, 1873, by Mr. Knobel, portrays the leading features of this region much as I have more recently observed them. In 1884, Mr. Knobel delineated the whole mass of shading outlying the north pole as blended uninterruptedly, but these differences are unquestionably due to the changes of inclination, which must necessarily introduce such discordances into the apparent forms of the markings as observed at different epochs.

As to the canal-shaped features of Schiaparelli, first seen in 1877 and 1878, and subsequently confirmed, I have distinguished a large number of appearances highly suggestive of such a configuration, but the Italian drawings made during the three months from October, 1881, to February, 1882, give them a definite character, and (apart from their duplication) a straightness of direction and general uniformity of tone which my observations do not confirm. The more delicate and complex markings on the planet appear to my eye, under the best circumstances, as extremely faint, linear shadings with evident gradations in tone and irregularities occasioning breaks and condensations here and there. If they existed under the same aspect and with the same boldness as delineated by Schiaparelli, they would have been readily detected here whenever the seeing was fairly good, for these objects are referred to as readily observed in the 8-inch refractor of the Milan Observatory in February, 1882, when the planet's diameter was only 13″. The duplication of these lines was also traceable under the same unfavourable conditions. The wonder is, not that the eminent Italian astronomer has discovered such a marvellous extent of curious detail on this planet, because this detail unquestionably exists, though scarcely in the form and character under which it is represented, but that he should have observed its more complex and difficult configuration at the very period when Mars was so very unfavourably situated for observations of this critical nature.

The surface markings of this planet are so numerous and varied that they are far from being adequately represented on existing charts. In certain regions the disk is so variegated as to give a mottled appearance. Dark lines, and spots, and bright spaces are so thickly interspersed, and so difficult to observe with sufficient steadiness to estimate their positions and forms, that I found it impossible to make thoroughly satisfactory drawings. An observer has to be content with endeavours to depict the more prominent marks only, and even in connection with these there is always some element of uncertainty. The rotation-period of the planet is, however, so slow, the hourly rate being only 14°·6 in comparison with 36°·7 in the case of Jupiter, that plenty of time is afforded for drawing the leading markings before they show a displacement obvious to the eye. In addition to this a drawing of Mars may be made to rest on several successive evenings of observation if the observer comes 37·4 min. later to the telescope on each occasion. In regard to Jupiter the difficulty of suitably drawing the details is far greater, though they admit of more ready observation. The rapid rotation of this planet displaces objects in a few minutes, and makes it imperative that the work both of observing and charting should be very hastily performed; and it is not feasible in this case to base a sketch on observations of following nights, because the markings are influenced by different velocities, and suffer large relative displacements even at short intervals of time.

During the past few months the north polar cap of Mars has been very bright, sometimes offering a startling contrast to those regions of the surface more feebly reflective. Some of the other parts were also notably brilliant. These luminous regions of Mars require at least as much careful investigation as the darker parts, for it is probably in connection with them that physical changes (if at present operating on the planet's surface) may be definitely observed. In many previous drawings and descriptions of Mars sufficient weight has not been accorded to these white spots.

Many of our leading treatises on astronomy attribute a dense atmosphere to Mars, but nothing has been observed during my recent observations to corroborate this theory. It seems to me far more plausible to assume that the atmosphere of this planet is extremely attenuated. The chief spots are invariably visible, and the phenomena occasionally observed are rather to be imputed to the vagaries of our own atmosphere than to that of Mars. Jupiter and Saturn are doubtless enveloped in dense vapours shrouding their real surfaces from terrestrial eyes. Their markings are atmospheric, though in some cases very durable, and constantly undergoing changes of aspect and displacements of position by longitudinal currents. On Mars a totally different nature of things prevails. Here the appearances descried are absolute surface markings displaying none of the variations which are so conspicuously displayed in the markings on Jupiter. It is probable that many, if not all, the changes supposed to have occurred in the features of Mars are simply attributable to the constantly varying conditions under which the planet has necessarily to be observed. Were the circumstances of observation more equable there would be much greater unanimity amongst observers of this interesting object. It seems to me that the very pronounced character of the markings and their great permanency are quite opposed to the idea that the planet is surrounded by a dense cloud-laden atmosphere.

W. F. DENNING

M. CORNU ON THE HYDROGEN FUNCTION OF CERTAIN METALS[1]

WHEN we examine on different photographs those groups of lines which reappear periodically with a particular regularity, we find that these groups belong

[1] Translation from an article in the *Journal de Physique*.

precisely to the category of those which reverse themselves; for some are reversed and the others are on the point of being so. For the same metals, the reversals are more or less complete according to the conditions of the experiment, and for different metals according to their chemical and physical properties.

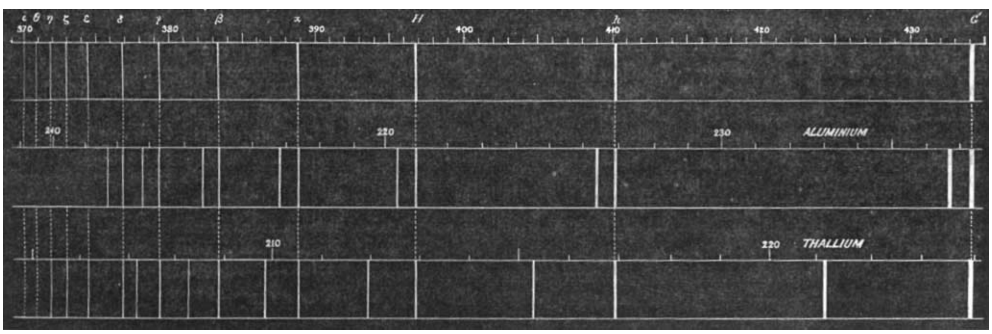
The law of distribution of these groups presents another common character relatively to the succession of distances and intensities: the lines get nearer together towards the more refrangible end, and diminish in intensity. This character is much the more striking when the number of reversed lines is considerable, because the field on which they appear is more uniform. It seems that with the elevation of temperature the spectrum tends towards a limit, that of a continuous brilliant background despoiled of all lines except the regular series of the self reversing ones. It is to this constitution that I wish to draw the attention of observers.

The number of metallic spectra capable of giving a regular series of spontaneously reversed lines on a continuous background is considerable; but the most beautiful series that I have observed were supplied by two metals which one could scarcely have anticipated, from a chemical point of view, to find side by side; these are aluminium and thallium, whose equivalents are at the extremity of the list of those of the simple bodies. The diagram gives an idea of the distribution of these reversed lines; one sees that they form in each spectrum a series of doublets fulfilling the conditions of distance and intensity given above.

I shall not stop to indicate the fruitless trials of numerical calculations that I have taken in hand in order to represent each of these series by the substitution of the series of entire numbers in a simple function; I may add that I had given up these researches until the discovery of Dr. Huggins on the spectra of white stars brought back my attention to this subject.

These spectra present, in fact, a common series of dark lines, that is to say, reversed, fulfilling precisely the conditions of distance and intensity which characterise in metallic spectra the spontaneously reversed lines: they prolong the series of well-known lines of the spectrum of hydrogen, C, F, G, *h*. One could then foresee that the whole series belonged to them; that is what has since been confirmed by Vogel, though this result is still not quite certain. The interest of this identification was such that I sought to prove it myself, which I could not realise till lately. The experiment is not without difficulty; but in taking more minute precautions to get rid of all impurity in the hydrogen, I have seen the impurity lines obliterated, and finally I succeeded in obtaining photographs showing the series of star-lines in all their purity.

The spectrum of hydrogen is placed on the first line in the above diagram: the comparison has been rendered easier by the choice of scales showing intuitively the identity of the law of distribution of lines in the three spectra.



DESCRIPTION OF THE DIAGRAM.—The graduations define the lines according to their wave-lengths. The first line represents the dark lines of the violet and ultra-violet spectra of the white stars. The second represents a double series of inverted lines in the ultra-violet spectrum of aluminium (electric arc). The scale of the drawing has been chosen in a manner to make G and δ coincide with the homologous lines of the first series (first line of each doublet). One could have operated in the same way with the second series (second lines). This mode of representation advantageously replaces the numerical tables, showing the verification of the two empiric formulas—

First series ... ... $\lambda_1 = 47{\cdot}30 + 0{\cdot}45783\,h$
Second series ... ... $\lambda_2 = 47{\cdot}18 + 0{\cdot}43678\,h$

which give the length of the wave of each line in function of the wave-length *h* of the corresponding line of hydrogen; the difference between the calculation and the observation is of the order of the experimental errors. The third line represents a double series of inverted lines in the ultra-violet spectrum of thallium (electric arc). The scale of the drawing was chosen like the one above; the empiric formulas which represent these two series are:—

$$\lambda_1 = 94{\cdot}61 + 0{\cdot}29776\,h$$
$$\lambda_2 = 111{\cdot}31 + 0{\cdot}75294\,h.$$

We might compare in the same way the more complex groups, like magnesium, zinc, sodium, &c.; the only difficulty is to establish the agreement of the groups; we do this immediately by a quite simple graphic construction. We arrive at the following statement, which resumes the whole of my researches. In the metallic spectra certain series of lines, spontaneously reversed, present sensibly the same law of distribution and intensity as that of the hydrogen lines.

It is not necessary to dwell on the importance of this relation: it makes evident the existence of a law which is general relatively to the emissive powers of incandescent vapours, and, again, it shows that this law of succession of spectral lines, common to so many series, seems to be expressed by the help of the same function, which one might call the hydrogenic function, which should play the principal part in these studies: the result then appears to constitute a first step towards the solution of the great problems which the spectroscope brings on for solution. R.

VEGETATION OF SOUTH GEORGIA

ON Tuesday, January 17, 1775, Capt. Cook landed on this remote island, which is situated about 1000 miles east of Cape Horn, in about 54° S. lat. and 37° W. long., and took possession of it in the name of King George the Third, after whom he named it. Capt. Cook landed in three different places, and the ceremony of adding the island to the British dominions, he informs us, was performed under a waving of colours and a discharge of small arms. Whether any British subject has ever set foot on it since that day I know not; but the description of the island by its famous discoverer was not likely to tempt any one to go out of his way with that object in view. Although